MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

EMT2036 – ENGINEERING MATHEMATICS III

(All Sections / All Groups)

26th Oct 2017

9.00am – 11.00am

(2 Hours)

GENERAL INSTRUCTIONS:

1. This exam paper consists of **4 pages** with **4 questions only**.
2. Each question is worth **25 marks. Attempt ALL questions.**
3. The required statistical book is provided.
4. Write all your answers in the answer booklet provided. **Show all relevant steps** to obtain maximum marks.

Question 1

(a) The operations manager of a large production plant would like to estimate the mean amount of time a worker takes to assemble a new electronic component. Assume that the standard deviation of this assembly time is 3.6 minutes. After observing 120 workers assembling similar devices, the manager noticed that their average time was 16.2 minutes.

(i) Construct a 92% confidence interval for the mean assembly time.

[7 marks]

(ii) The manager noticed that another sample of 120 workers needed 16.9 minutes to do the same job. Construct a 92% confidence interval for the mean assembly time.

[3 marks]

(iii) If the population mean for this population is 17.0, which of the confidence interval constructed in (i) and (ii) covers this population mean.

[2 marks]

(b) **Using cylindrical coordinates**, evaluate $\iiint_E x^2 dv$, where E is the solid that lies within the cylinder $x^2 + y^2 = 1$, above the plane $z = 0$, and below the cone $z^2 = 4x^2 + 4y^2$.

[13 marks]

Continued...

Question 2

(a) Use Green's theorem to evaluate the line integral

$$\int_C (x^2 - y^2)dx + xydy,$$

where C is the positively oriented closed curve given by $y = x^2$ and $y = -x + 2$ between (–2, 4) and (1, 1).

[13 marks]

(b) Show that the vector $\mathbf{F} = (4xy + z^2)\mathbf{i} + 2x^2\mathbf{j} + 2xz\mathbf{k}$ is conservative, and hence evaluate $\int_C (4xy + z^2)dx + 2x^2dy + 2xzdz$, where C is the straight line from $(1, 3, 1)$ to $(2, 2, 6)$.

[12 marks]

Question 3

(a) Solve the following system of linear equations by using Cramer's rule:

$$2x + 4z = 3y + 17$$
$$x + 2y - 4z + 7 = 0$$
$$2z - y + 3x = 14$$

[12 marks]

(b) Use elementary row operations to determine the inverse of the matrix:

$$\begin{bmatrix} 4 & 1 & 6 \\ 2 & 1 & 3 \\ 3 & 2 & 5 \end{bmatrix}$$

[13 marks]

Continued...

Question 4

(a) Determine whether the following vectors are linearly independent or dependent:

$$u = [3 \quad 1 \quad 6] \qquad v = [2 \quad 0 \quad 4] \qquad w = [2 \quad 1 \quad 4]$$

[4 marks]

(b) Compute AB using block multiplication where

$$A = \left[\begin{array}{ccc|cc} 2 & -3 & 1 & 0 & -4 \\ 1 & 5 & -2 & 3 & -1 \\ \hline 0 & -4 & -2 & 7 & 1 \end{array}\right] \qquad B = \left[\begin{array}{cc} 6 & 4 \\ -2 & 1 \\ -3 & 7 \\ \hline -1 & 3 \\ 5 & 2 \end{array}\right]$$

[11 marks]

(c) The eigenvalues of matrix $A = \begin{bmatrix} 7 & -4 \\ 5 & -2 \end{bmatrix}$ are 2 and 3, and the corresponding eigenvector are $\begin{bmatrix} 4/5 \\ 1 \end{bmatrix}$ and $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$. Find the general solutions of the given system

$$x_1' = 7x_1 - 4x_2$$
$$x_2' = 5x_1 - 2x_2$$

by using the given eigenvalues and eigenvectors of the coefficient matrix.

[10 marks]

End of paper.